G 1125

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Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, MAY 2016

Seventh Semester

Branch : Electrical and Electronics Engineering

CONTROL SYSTEMS – II (E)

(Old Scheme—Prior to 2010 Admissions)

[Supplementary/Mercy Chance]

Time : Three Hours

Maximum : 100 Marks

Part A

Answer **all** *questions.*
Each question carries 4 *marks.*

1. Briefly explain the difference between lag and lead compensators.
2. Briefly explain the characteristics of cascade compensation.
3. State and explain July's stability criterion.
4. State sampling theorem and discuss its significance.
5. Briefly discuss the classification of singular points.
6. Briefly discuss any *three* non-linearities present in physical systems.
7. What is state transition matrix ?
8. Briefly explain the non-uniqueness at the set of state variables with an example.
9. Briefly discuss the terms controllability and observability.
10. Derive the relation between transfer function and state space model of a system.

(10 × 4 = 40 marks)

Part B

Answer **all** *questions.*
Each full question carries 12 *marks.*

11. The open loop T.F. of a system is $\frac{10}{s(s+4)}$. Design a lag compensator such that the velocity error constant is increased to 50 sec^{-1} without appreciably changing the location of dominant poles at $-2 \pm j\sqrt{6}$ using root locus method.

Or

12. Explain the steps involved in the design of a lead compensator using Bode plot with an example.

Turn over

13. The open loop T.F. of a unity feedback discrete time system is given by :

$GH(z) = \dfrac{K(0.368z + 0.264)}{z^2 - 1.36z + 0.368}$. Determine the range of K for stability using Jury's test.

Or

14. Obtain the solution for :

$$y(k+3) + 2y(k+2) + 3y(k+1) + y(k) = r(k)$$

where $r(0) = 1$ and $r(k) = 0$ for $k < 0$.

15. Identify and classify the singularities of the system whose differential equation is given by :

$$\ddot{y} + 0.5\dot{y} + 2y + y^2 = 0.$$

Also sketch the phase trajectories near the singular point.

Or

16. Obtain the describing function of a saturation non-linearity.

17. A system is represented by the equation :

$$\dot{X} = \begin{bmatrix} 0 & 2 \\ -2 & -5 \end{bmatrix} X + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u$$

$$y = [2 \quad 1]X \qquad X(0) = [1 \quad 2]^T.$$

Determine the time response of the system.

Or

18. A system matrix is given by $A = \begin{bmatrix} 2 & 1 & 4 \\ 0 & 2 & 0 \\ 0 & 3 & 1 \end{bmatrix}$. Determine the state transition matrix.

19. Determine a suitable state representation for the difference equation :

$$y(k+3) + 3y(k+2) + 2y(k+1) + y(k) = u(k+2) + 2u(k+1) + u(k).$$

Or

20. A system has the T.F. $\dfrac{y(s)}{u(s)} = \dfrac{s+6}{s^2 + 5s + 6}$. Check the controllability and observability of the system.

(5 × 12 = 60 marks)